

# **A Computer-Based Informational System To Aid Southern Pine Beetle Control Operations**



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# A COMPUTER-BASED INFORMATIONAL SYSTEM TO AID SOUTHERN PINE BEETLE CONTROL OPERATIONS

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### Abstract

In 1973, the Texas Forest Service developed and implemented a computer-based informational system to monitor southern pine beetle detection, ground check and control operations on state and private forests in East Texas. After more than five years of operation, the system has proven effective for monitoring all levels of beetle

activity, including increasing and declining populations. The voluntary support and cooperation of Texas Forest Service and forest industry personnel have played an integral part in the success of the system.

*Keywords:* electronic data processing system, southern pine beetle

# A COMPUTER-BASED INFORMATIONAL SYSTEM TO AID SOUTHERN PINE BEETLE CONTROL OPERATIONS

## Introduction

The southern pine beetle, *Dendroctonus frontalis* Zimm. (Coleoptera: Scolytidae) is considered one of the most destructive forest insects in East Texas. Periodic outbreaks have been reported as far back as the late 1800's. The most recent East Texas outbreak began in 1958 and persisted through 1977 (fig. 1). During 1976, beetle populations reached the highest levels ever known, while populations dropped to the lowest levels experienced in 20 years by 1978.

The Texas Forest Service (TFS) is responsible for providing forestry assistance to private forest landowners of East Texas. The Pest Control Section of this agency--headquartered in Lufkin--provides guidance, training, supervision and evaluation regarding forest pests in Texas. Included in these responsibilities is the task of keeping records of forest insect and disease outbreaks.

In order to keep abreast of the southern pine beetle (SPB) situation, single engine aircraft are used to survey the pine forests of East Texas (about 12 million acres) for evidence of beetle infestations. After a beetle "spot" (a group of dead or dying pines killed by SPB) has been detected, it is usually checked on the ground to determine the presence of beetles and the need for control. Finally, if warranted, the landowner is urged to implement direct control. Individual records for all beetle spots are kept for each phase of the operation: detection,

ground check and control. During years when 3000-6000 SPB spots are detected (nearly 11,000 in 1976), the need for efficient methods of handling large amounts of data becomes apparent.

Prior to 1973, detection, ground check and control information for all SPB spots was handwritten in large ledger books maintained in TFS field offices. This record-keeping system was time consuming; also the retrieval and summarization of detection and control information was difficult. With the cooperation of large timber companies in East Texas, the TFS initiated the 'Operations Informational System' (OIS) in March 1973 to facilitate state wide SPB record-keeping operations. The foundation of the OIS was a set of computer programs developed to facilitate timely access of all pertinent SPB spot information.

## The Operations Informational System — an Overview

Record-keeping and data management have become both a science and an art. The OIS evolved from the experience of various individuals and organizations involved with SPB operations in East Texas during the past 20 years.

The computer-based system was designed to assist the field professional or technician to accomplish his job more efficiently and to simultaneously provide capsuled summaries to middle and top level managers. As its name indicates, the system was intentionally oriented to operations rather than to



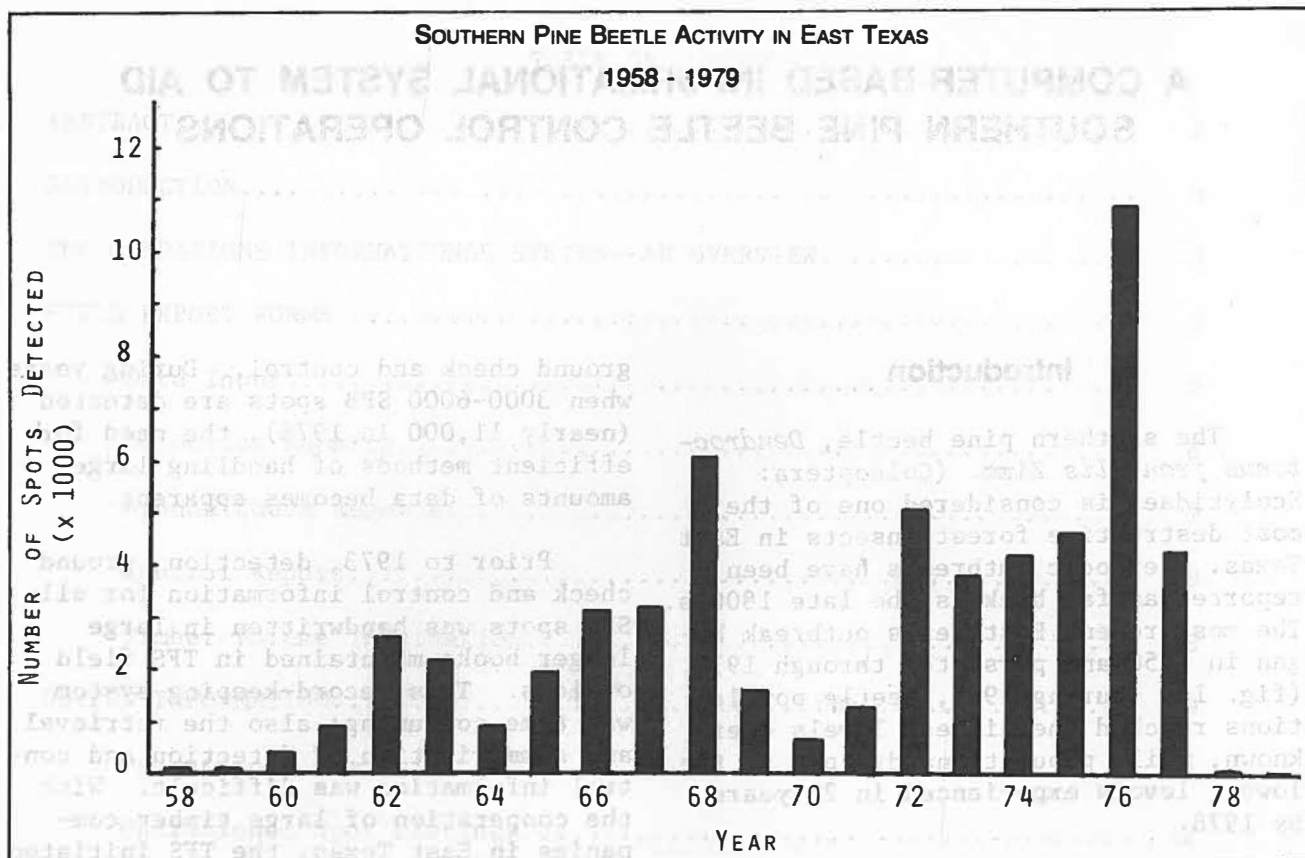


Figure 1. Southern Pine Beetle Spots Detected in East Texas from 1958-1979.

research. For the system to become widely accepted and used by field and administrative cooperators, feedback of information to the field had to be frequent, punctual and in an easily understood format; forms for reporting field data had to be simple, with coding kept to a minimum. Also, a practical and simple way to update and correct information was essential. The field report could not require time-consuming or unduly precise information, and, if possible, it should replace an already existing report. Finally, the system had to be flexible and provide the reporter with some degree of originality.

As indicated in the simplified flow chart (fig. 2), the system involves up to three different input records on each SPB spot: (1) a detection or flight report usually following an aerial survey, (2) a ground check re-

port which provides information about a spot after it has been examined on the ground, and (3) a control report which indicates how and when the spot was controlled and the volume of timber affected. Upon collection by field crews, information on a spot is sent to the Pest Control Section in Lufkin to be edited and punched on computer cards (prior to 1978) or placed on a direct access file via remote terminal. Several Fortran computer programs developed by the TFS Forest Management Department sort and summarize the data onto printouts providing current lists of SPB spots needing ground check or control action. These spot listings are then distributed periodically to more than 55 TFS District and forest industry field offices. In addition, supervisors are provided summaries of pest activity and the status of control programs for their respective areas. Computer printouts are mailed bi-weekly

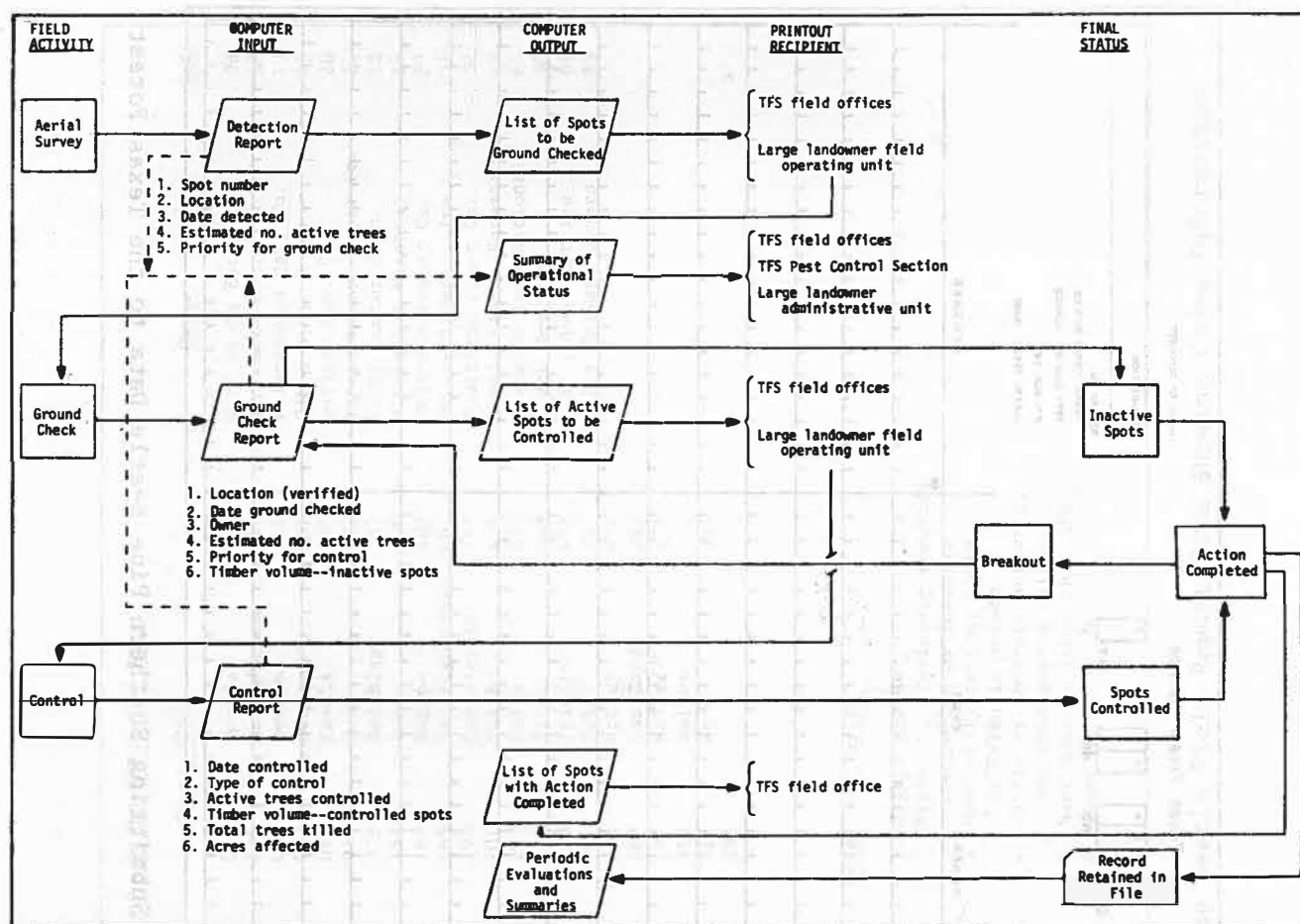


Figure 2. Flow Chart for Texas' Computerized Southern Pine Beetle Operations Informational System.

during the active beetle season (usually April-October) and less frequently when beetle activity is low.

### Field Report Forms

Because record keeping and reports require time and money, items which might be "nice to know," but of questionable use, were excluded. The information required on field reports for the OIS was kept to a minimum.

A simple field report form (on legal size paper) with space provided to report up to 15 SPB spots is used to enter all spot information into the OIS (fig. 3). Codes necessary to report required information are identified on the reverse side of each report form (fig. 4). The field report forms also

have key fields marked with column numbers so that data may be transferred directly to the computer. The form includes space for the reporter's name and organization so that if additional information is needed, the proper contact can be made.

Several timber companies requested space on the initial report form to record timber volume data for individual SPB spots. Beginning in 1974, the field report form was modified so that salvaged and non-salvaged volume, number of trees, and acreage could be included (see "Timber Volume Information" for details).

### Data Input

Reporters are encouraged to submit the report forms to the Pest Control

[illegible]

NAME OF REPORTER:

**TFS FLIGHT SECTOR**

DATE \_\_\_\_\_

3	4
---	---

mo

69

197 L  
y

## ORGANIZATION

## ORGANIZATION

RETURN TO

TEXAS FOREST SERVICE

PEST CONTROL SERVICE

P.O. BOX 319

LUFKIN, TEXAS 75907

TFS  
SPOT  
NO.

TYPE	ACTION
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
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84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

TFB

GRID

**COUN**  
**COB**

**ABS\***

**OWNER**

300 - 000

SPOT

**ESTIMATE  
NUMBER**

**PRIORITY**

TYPE CO

WNEA

NAME

1

REMA

RKB

22

11

Figure 3. Front of the Field Report Form Used for Submitting Southern Pine Beetle Data to the Texas Forest Service Operations Informational System.

SPB CODING - FIELD REPORTING FORM									
Code	Type Action			County Code		Owner		Code	
1	Flight report	Anderson	001	Morris	343	Wirt Davis Est.		08	
2	Correction flight report	Angelina	005	Nacogdoches	347	T. Foster Est.		12	
3	Ground Check	Bowie	037	Newton	351	Friendswood Dev. Co.		13	
4	Correction ground check	Camp	063	Orange	361	Gibbs Bros. & Co.		15	
5	Control action	Cass	067	Panola	365	Horizon Dev. Co.		20	
6	Correction control action	Chambers	071	Polk	373	International Paper Co.		21	
		Cherokee	073	Red River	387	Kirby Lumber Corp.		22	
		Franklin	159	Rusk	401	Mitchell & Mitchell		24	
		Gregg	183	Sabine	403	Ogletree Lumber Co.		29	
		Grimes	185	San Augustine	405	Owens-Illinois, Inc.		31	
		Hardin	199	San Jacinto	407	Southland Paper Co.		38	
		Harris	201	Shelby	419	Temple Eastex Forests		45	
		Harrison	203	Smith	423	Champion International		46	
		Henderson	213	Titus	449	Bosch Dev. Co.		50	
		Houston	225	Trinity	455	U.S. Forest Service		88	
		Jasper	241	Tyler	457	Other Private Owners		99	
		Jefferson	245	Upshur	459				
		Leon	289	Van Zandt	467				
		Liberty	291	Walker	471				
		Madison	313	Waller	473				
		Marion	315	Wood	499				
		Montgomery	339						

TFS Grid

A	B	C
H	13	D
G	F	E

Dot location shown by letter designation, begin in NW corner going in a clockwise direction. Grid 483 B 12' would be recorded 483 B 12 C

Code	Type Control
1	Salvage
2	Pheromones
3	Fell Only
4	Fell and Top
5	Insecticides
6	Combination

Code	Priority
1	Highly active
2	Breakout, previously reported controlled or inactive
3	Moderately active, large salvageable volume
4	Little or moderate activity, low salvageable volume
5	Bark beetles other than SPB
6	Inactive

Figure 4. Back of Texas Forest Service Southern Pine Beetle Field Report Form Showing Coded Information.



Section in Lufkin as the work on spots is performed. Prompt reporting assures that the bi-weekly computer printouts provide current information.

Each report requires a "type action" code. This code signifies the type of information being reported. The codes are:

<u>Type Action</u>	<u>Activity</u>
1	Detection or initial report
2	Correction of a detection report
3	Ground check report
4	Update or correction of a ground check report
5	Control report
6	Update or correction of a control report

The type action code allows the computer programs to combine all information submitted on any given spot into one updated record depicting the spot's current status.

#### Detection Reports

The initial input of data usually follows an aerial detection flight. TFS crews regularly fly over the East Texas infestation area; some timber industries also conduct detection flights to supplement TFS surveys. Although most spots are detected from the air, a few are first reported from ground observation.

Individual SPB spots are assigned an unique 4-digit number. This spot numbering system begins anew each year in January. Any spots that remain active (uncontrolled) from the previous year are designated "carryovers" and are assigned a new number.

A detection report (type action 1) is the first information received on a spot. A description of the various fields on the report form and the information needed for a detection report follows. The TFS area and flight sector are used by the TFS to divide the forested area of East Texas into administrative areas. The date should reflect when the work or action was performed and not when the field report was completed. The TFS grid is unique to Texas and is a system of numbers and letters used to describe any geographical location to within five (5) acres. Owner (for forest industries) and county are assigned special codes that are enumerated on the back of the field report form. The survey abstract number is a special number given to tracts of land in East Texas. For the OIS, this item is optional.

Some timber companies divide their lands into administrative units with a different field office responsible for each unit. In this case, the company assigns an owner sub-unit code to identify these areas. This allows the computer to segregate the company spot listings on the printout according to the sub-unit code. The owner spot number is reserved for use by companies that may have an internal numbering system for infestations on their lands.

The aerial estimate of the number of active trees is used to indicate the size of the spot. This estimate is based on the number of red- and yellow-crowned trees visible to aerial observers at time of detection. Although there may be considerable discrepancy between the aerial estimate and actual number of active trees (i.e. those containing bark beetle broods), the initial aerial estimate is useful for deciding which spots to ground check first. Historical records reveal that spots appearing large from the air will tend to be large on the ground, and conversely, spots that appear small from the air will usually be small or

already inactive (vacated by the beetles) when checked on the ground. Priority is an appraisal of the need for rapid attention by ground crews. Each spot is assigned an initial priority by aerial observers, based on visible criteria of spot size, value of resource threatened, apparent level of beetle activity, access and other factors.

The space provided for owner name is used for entering the name of individuals or small companies who do not have an assigned owner code. The remarks section can be utilized in many ways, but is most commonly used to more precisely describe spot location. An example of a detection report is shown in figure 5.

A type action 2 report is used only when a previously-submitted detection report needs to be corrected.

#### Ground Check Reports

A ground check report (type action 3) provides more accurate information on a previously-detected spot after it has been evaluated by ground crews. Ground check reports require the following information: TFS area, TFS flight sector, date spot was ground checked, TFS spot number, type action, estimated number of active trees, and control priority (fig. 6). Number of active trees on the ground check report, unlike the aerial estimate, should reflect the actual number of trees containing bark beetle broods. The priority rating indicates the need, if any, for immediate control action.

An error in a type action one or two report can be corrected on the ground check report. The computer will reject a ground check report that has not been preceded by a detection report. Corrections to a previously-submitted ground check report are entered as a type action 4. Procedures for submitting a type action 4 report are similar to those for the type action 2 report.

#### Control Report

A control report (type action 5) includes the following items: TFS area and flight sector, date of control, TFS spot number, type action, estimated number of active trees at time of control, and code for type control implemented. Again, other information already in storage need not be reported a second time unless a change is in order. A type action 6 report is used when it is necessary to correct previously-submitted control information and would follow the pattern of the other correction reports.

#### Timber Volume Information

When the final action on a spot is reported (inactive or controlled), volume information should be reported if available (fig. 7). This information is useful for tax purposes, depletion figures, measures of operational efficiency or other reasons.

All volume data is reported in cubic feet and rounded as indicated on the bottom of the form. Portions of the owner name and remarks sections have been altered to accommodate this information. When volume information is not reported, the entire owner name and remarks section can be used in the normal way. All reports containing volume information are coded with a 1 in column 80. This allows the volume data to be separated for annual volume summaries (see fig. 8, 9, 10) for the state and individual companies.

#### Output Information

Throughout the season of peak SPB activity (April-October) data from field offices are received daily at the Pest Control Section. The data are processed by several computer programs and printed in the form of up-dated summaries and listings. The OIS output consists of summaries of detection, ground check and control reports; a

SOUTHERN PINE BEETLE FIELD REPORT

Texas Forest Service

NAME OF REPORTER J. T. Johnson

ORGANIZATION TFS

RETURN TO  
TEXAS FOREST SERVICE  
PEST CONTROL SERVICE  
P.O. BOX 310  
LUFKIN TEXAS 75901

TFS AREA 4 TFS FLIGHT SECTOR 3

DATE 6 26 7  
mo. day yr.

TFS SPOT NO.	TFS GRID	COUNTY CODE	ABSTRACT NO.	OWNER	OWNER SUB-UNIT	OWNER SPOT NO.	ESTIMATED NUMBER ACTIVE TREES	PRIORITY	TYPE CONTROL IMPLEMENTED	VOLUME		CU. FT. *		REMARKS	TOTAL KILL		
										SALVAGED PULPWD.	SAWLOG	NOT-SALVAGED PULPWD.	SAWLOG		NUMBER TREES NON-MERCH. SIZE	MERCH. SIZE	ACRES**
3668	227A	4B	373		9.9		351			JESSE JAMES				S OF RR	HOT SPOT		
3669	279C	14	373		4.6	3	251							N OF POWERLINE			
3670	269T	10A	373		9.9		401			KAY MART							
3671	273G	7F	373		4.6	3	104							EDGE OF PLANTATION			

Figure 5. Example of a Completed Detection Report for Several Southern Pine Beetle Spots.

SOUTHERN PINE BEETLE FIELD REPORT

Texas Forest Service

NAME OF REPORTER E. Smith

ORGANIZATION TFS

RETURN TO  
TEXAS FOREST SERVICE  
PEST CONTROL SERVICE  
P.O. BOX 310  
LUFKIN TEXAS 75901

TFS AREA 3 TFS FLIGHT SECTOR 2

DATE 8 21 8  
mo. day yr.

TFS SPOT NO.	TFS GRID	COUNTY CODE	ABSTRACT NO.	OWNER	OWNER SUB-UNIT	OWNER SPOT NO.	ESTIMATED NUMBER ACTIVE TREES	PRIORITY	TYPE CONTROL IMPLEMENTED	VOLUME		CU. FT. *		REMARKS	TOTAL KILL		
										SALVAGED PULPWD.	SAWLOG	NOT-SALVAGED PULPWD.	SAWLOG		NUMBER TREES NON-MERCH. SIZE	MERCH. SIZE	ACRES**
8213							16										
7143							751							S OF BRANCH			
7183							301							LARGE TIMBER			
7623							153							ALMOST INACTIVE			

Figure 6. Example of a Completed Ground Check Report for Several Southern Pine Beetle Spots.

SOUTHERN PINE BEETLE FIELD REPORT										Texas Forest Service				NAME OF REPORTER <b>ARNOLD</b>	
TFS AREA		TFS FLIGHT SECTOR		DATE		DATE		DATE		DATE		DATE		DATE	
TFS AREA		TFS FLIGHT SECTOR		DATE		DATE		DATE		DATE		DATE		DATE	
TFS AREA		TFS FLIGHT SECTOR		DATE		DATE		DATE		DATE		DATE		DATE	
SPOT NO.	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
TFS ACTION	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
COUNTY CODE	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
ABSTRACT NO.	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
OWNER	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
SUB-UNIT	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
ESTIMATED NUMBER ACTIVE TREES	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
PRIORITY	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
TYPE CONTROL IMPLEMENTED	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
VOLUME - CU. FT. #	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
SALVAGED PULPWOOD	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
NOT-SALVAGED PULPWOOD	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
SALVAGED SAWLOG	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
NOT-SALVAGED SAWLOG	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
REMARKS	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
NUMBER TREES NON-MERCH. SIZE	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
ACRES #	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259
TOTAL KILL	11245	11246	11247	11248	11249	11250	11251	11252	11253	11254	11255	11256	11257	11258	11259

Figure 7. Example of a Field Report Showing Volume Data for Controlled and Inactive Southern Pine Beetle Spots.

list of active SPB spots needing ground check; a list of active SPB spots that have been ground checked and warrant control; and, finally, a list of spots reported with incomplete or insufficient information.

These reports keep managers at all levels informed of their current beetle situation and help to make short-term work planning and decision-making more efficient. With this information, pest managers can determine whether ground check and control efforts are adequate.

### Operational Summaries

Administrators receive brief summaries of the beetle situation twice each month throughout the beetle season. For the companies, the summaries include beetle activity specific to their lands and, for comparative purposes, state totals for each category listed (fig. 11). The report, printed in table form, consists of the following items: (1) total number of spots detected since 1 January, (2) number of spots on which action is complete (i.e. reported as controlled or inactive), (3) number of SPB spots controlled, (4) number of SPB trees controlled (i.e. summation of active trees reported at the time of control), (5) number of spots to be ground checked, (6) number of spots that have been ground checked but not yet controlled, (7) number of spots lacking control 30 days since detection, (8) number of spots with incomplete or insufficient information (spots reported with less than the required minimum information). The number of inactive spots, an item of interest for estimating population trends, can be obtained by subtracting the number of controlled spots from those with action completed.

TFS field administrators (Area Foresters) also receive summaries of beetle activity in their area. The summary is similar to company reports except that all beetle spots are listed regardless of owner. However, spots on company lands are segregated from those



SUMMARY OF SOUTHERN PINE BEETLE-  
KILLED TIMBER LOSSES DURING 1977

STATE TOTALS BY COOPERATOR

*****										
TOTAL NUMBER OF SPOTS			TOTAL TIMBER VOLUME NUMBER OF TREES AND ACRES							
COOPERATOR	DETECTED	CONTROLLED	WITH	SALVAGED		NON-SALVAGED		TOTAL KILL		ACRES
			VOLUME	PULPWOOD	SAWLOGS	PULPWOOD	SAWLOGS	NON-MERCH. TREES	MERCH. TREES	
*****										
-----CUBIC FEET-----										
OWNER A	145	58	73	43330	8790	26040	6930	903	7920	74.1
OWNER B	1422	1161	1237	70300	1143860	243480	1178660	7878	142761	9714.4
OWNER C	125	89	107	178480	58770	91590	43820	1343	14277	188.6
OWNER D	392	209	237	528300	910990	41530	1-4070	11814	60042	1081.0
OWNER E	1928	433	1053	1466720	1057550	648740	315430	43475	207093	2561.7
STATE TOTAL	4012	1950	2707	2287130	3179960	1051380	1648910	65413	432093	13619.8
*****										

Figure 8. Example of Annual Summary of Reported Timber Losses to Southern Pine Beetle in East Texas for Each Assigned Owner Code (timber companies and small private owners).

on private, non-industrial lands so the TFS Area Forester can distinguish his work load and still be informed of the overall beetle situation for his area (fig. 12). Again, state totals are listed for comparative purposes.

### Operational Spot Listings

Listings of SPB spots needing ground check or control action also are provided bi-weekly. For TFS offices, separate lists are produced for each flight sector and include both timber industry and small private spots. The lists are sorted so that spots for each company are listed first, followed by the spots on small private owner-ships. All spots are arranged in ascending order by TFS spot number. Since spot numbers are assigned as the spots are detected, this report provides a chronological listing. TFS spot listings showing ground check and control workloads are shown in figures 13 and 14.

The operational spot listings for company field foresters are similar to

the TFS listings (see fig. 15 and 16). Each company listing is divided according to its assigned owner code and owner sub-unit, but data pertaining to other owners is omitted. Each field supervisor receives a list of spots needing ground check or control action within his work unit.

For the operational spot listings, the spots needing ground check will show the detection date, while the listing of spots to be controlled will show the ground check date. The listing of spots to be ground checked includes only those spots that have been detected, but not yet ground checked; the listing of spots to be controlled consists of active spots that have been ground checked but not yet controlled. Each field supervisor is sent two copies of the list so that he may keep one for his reference and distribute one to his crews for use in the field.

Once a spot has been reported as inactive or controlled, it no longer will appear on the operational spot

COOPERATOR: XYZ TIMBER COMPANY

TEXAS FOREST SERVICE  
DATE 01-26-78SUMMARY OF REPORTED SOUTHERN PINE BEETLE-  
KILLED TIMBER LOSSES DURING 1977  
BY TYPE OF TREATMENT AND SPOT SIZE\*\*\*\*\*  
TOTAL TIMBER VOLUMES, NUMBER OF TREES AND ACRES  
(INCLUDES ONLY SPOTS WITH DATA)

TYPE OF TREATMENT	SPOT SIZE CLASS ACTIVE TREES	TOTAL SPOTS		INDICATED SAMPLE	SALVAGED		NON-SALVAGED		NON-MERCH. TREES	MERCH. TREES	ACRES
		DETECTED	WITH VOLUME DATA		PULPWOOD	SAWLOGS	PULPWOOD	SAWLOGS			
		-----NUMBER-----		PERCENT	-----CUBIC FEET-----					-----NUMBER-----	
SALVAGE	0-25	125	100	80.0	123750	54830	3340	11310	1693	11883	85.1
	26-50	71	63	88.8	185490	148640	680	2090	2100	17249	166.3
	51+	132	116	87.9	1147440	852190	43930	86690	31564	124730	1392.3
CUT-AND-LEAVE	0-25	37	24	64.9	2450	500	2360	15490	425	681	9.6
	26-50	15	13	86.7	0	0	2660	2970	220	831	5.4
	51+	15	11	73.4	0	0	40360	7540	378	2022	28.5
OTHER CONTROL	0-25	34	1	3.0	0	0	140	0	0	25	.3
	26-50	2	1	50.0	0	0	210	0	0	35	1.0
	51+	2	1	50.0	0	0	380	3370	0	750	20.0
INACTIVE	0-25	1100	549	50.0	7440	0	129420	95730	4247	20455	217.1
	26-50	219	102	46.6	150	1390	34610	59910	1937	6835	82.3
	51+	155	72	46.5	0	0	390650	30330	911	21597	533.8
NO CONTROL OR	0-25	17	0	.0	0	0	0	0	0	0	.0
NONE REPORTED	26-50	1	0	.0	0	0	0	0	0	0	.0
	51+	3	0	.0	0	0	0	0	0	0	.0

\*\*\*\*\*  
SPOT SIZE IS DETERMINED FROM GROUND CHECK DATA IF AVAILABLE OTHERWISE FROM FLIGHT ESTIMATES.

Figure 9. Annual Summary of Reported Timber Losses to Southern Pine Beetle in East Texas by Type of Control and Spot Size for One Owner.

OWNER 30 SUB-UNIT 4				TEXAS FOREST SERVICE DATE 01-24-78							
TFS SPOT NO.	TFS GRID	COUNTY CODE	CONTROL DATE	VOLUME-CUBIC FEET		NUMBER TREES		ACRE	COOP SPOT NUMBER	ABSTRACT NUMBER	
				SALVAGED PULPWD	NOT SALVAGED SAWLOG	NON-MERCH. SIZE	MERCH. SIZE				
*****											
1500	229Y 2G	37	8/ 1/77		60	8	62	10	2	576	
5000	123X 1A	387	9/23/77	100	22	20	67	10	4	73	
5002	74X 9H	387	9/23/77	100	4	130	370	20	3	675	
5016	124S 2G	387	9/20/77	200	37	15	222	25	17	920	
5017	124S 7H	387	9/20/77	200	37	15	222	25	18	920	
5018	124S 5A	387	6/20/77		5		4	1	19	0	
5019	124T 3E	387	6/20/77		10		15	1	20	0	
5021	175C11B	387	8/ 1/77		10		18	5	0	0	
*****											

Figure 10. Year-End Listing of Reported Timber Volume Data for Individual Southern Pine Beetle Spots for a Given Owner Code.

REPORT DATE 11-03-77	TEXAS FOREST SERVICE	
SOUTHERN PINE BEETLE SUMMARY FOR XYZ TIMBER CO.	TFS OWNER CODE 30	
	COOPERATOR	STATE TOTALS
NUMBER OF SPOTS DETECTED SINCE JANUARY 1	366	4504
NUMBER OF SPOTS ON WHICH ACTION IS COMPLETE	258	3903
TOTAL SPB SPOTS CONTROLLED	166	2042
TOTAL SPB TREES CONTROLLED	13341	151807
NUMBER OF SPOTS WITH INCOMPLETE INFORMATION	0	0
NUMBER OF SPOTS TO BE GROUND CHECKED	4	337
NUMBER OF SPOTS LACKING CONTROL - HAVE BEEN GROUND CHECKED	104	264
NUMBER OF SPOTS LACKING CONTROL - 30+ DAYS SINCE DETECTION	105	596

Figure 11. Example of Bi-weekly Summary of Southern Pine Beetle Operations for a Timber Company.

REPORT DATE 7-13-77	TEXAS FOREST SERVICE			
SOUTHERN PINE BEETLE SUMMARY FOR TFS AREA 4				
	COOPERATORS	TFS	AREA TOTALS	STATE TOTALS
NUMBER OF SPOTS DETECTED SINCE JANUARY 1	1510	240	1750	3561
NUMBER OF SPOTS ON WHICH ACTION IS COMPLETE	1007	80	1087	1963
TOTAL SPB SPOTS CONTROLLED	903	10	913	1301
TOTAL SPB TREES CONTROLLED	60847	1039	61886	94639
NUMBER OF SPOTS WITH INCOMPLETE INFORMATION	0	0	0	0
NUMBER OF SPOTS TO BE GROUND CHECKED	372	78	450	1008
NUMBER OF SPOTS LACKING CONTROL	131	82	213	590
NUMBER OF SPOTS LACKING CONTROL - 30+ DAYS SINCE DETECTION	378	160	538	1225

Figure 12. Example of Bi-Weekly Summary of Southern Pine Beetle Operations for a Texas Forest Service Administrative Area.



REPORT DATE 10-04-78					TEXAS FOREST SERVICE		
LISTING FOR TFS AREA 5, FLIGHT SECTOR 1							
SPB SPOTS TO BE GROUND CHECKED							
SPOT NO.	FLIGHT DATE	TFS GRID	COUNTY	ABST. NO.	EST. NO. ACTIVE TREES	PRIORITY	REMARKS
*****							
NAME -				XYZ TIMBER CO.		OWNER CODE 30	
1000	8/30/8	117K 5E	471	0	10	4	50 YD S OF RR TRACK
1001	9/26/8	117J 7	471	0	100	1	
1003	9/26/8	119Y10A	471	0	35	1	
1004	9/26/8	117L11H	471	0	10	4	
1005	9/26/8	68M15	471	0	15	4	
1006	9/26/8	116S 8A	471	0	40	1	SO OF POWERLINE
NAME -				ABC TIMBER COMPANY		OWNER CODE 40	
1007	9/26/8	171W 4G	407	0	15	4	
1008	9/26/8	168A12B	407	0	25	3	
NAME - JESSIE JAMES						OWNER CODE 99	
1002	9/26/8	69L 7G	471	0	15	4	
NAME - J H MORRISON						OWNER CODE 99	
1009	9/26/8	171W 8H	471	0	30	3	
*****							

Figure 13. Sample Listing of Southern Pine Beetle Spots Needing Ground Check Action for a Texas Forest Service Administrative Area and Flight Sector

REPORT DATE 10-04-78					TEXAS FOREST SERVICE			
LISTING FOR TFS AREA 5, FLIGHT SECTOR 5 SPB SPOTS TO BE CONTROLLED								
TFS SPOT NO.	GROUND CHECK DATE	TFS GRID	COUNTY CODE	ABST. NO.	EST. NO. ACTIVE TREES	PRIORITY	REMARKS	
*****								
NAME - XYZ TIMBER CO.							OWNER CODE 30	
5025	7/31/8	264H10B	185	0	12	4	N OF OPEN AREA	
5027	8/01/8	263B 7	185	0	20	3		
NAME - J B BREWER							OWNER CODE 99	
5002	7/25/8	264H10	185	0	12	4		
NAME - BILL E KIDD							OWNER CODE 99	
5003	7/28/8	264M 4B	185	0	30	1	S OF CLEARCUT	
NAME - RONALD MCDONALD							OWNER CODE 99	
5004	6/24/8	264N 6	185	0	10	3		
NAME - BILL FOLD							OWNER CODE 99	
5005	7/31/8	264D11	185	0	25	3		
NAME - M JOHNSON							OWNER CODE 99	
5006	7/31/8	314B15E	185	0	10	4	N OF POWERLINE	
NAME - I WASH							OWNER CODE 99	
5007	8/10/8	314M16A	185	0	40	1	MOVING FAST	
*****								

Figure 14. Sample Listing of Southern Pine Beetle Spots Needing Control Action for a Texas Forest Service Administrative Area and Flight Sector.

REPORT DATE 10-04-78						TEXAS FOREST SERVICE			
LISTING FOR XYZ CO. SUB-UNIT 2									
SPB SPOTS TO BE GROUND CHECKED									
TFS AREA	TFS SPOT NO.	OWNER SPOT NO.	FLIGHT DATE	TFS GRID	COUNTY CODE	ABST NO.	EST. NO. ACTIVE TREES	PRIORITY	REMARKS
*****									
5	1000	2001	9/26/8	117K 5E	471	0	10	4	S OF CREEK
5	1001	2030	9/26/8	117J 7	471	0	15	4	
5	1003	2035	9/26/8	119Y10A	471	0	15	4	
5	1004	2040	9/26/8	117L11H	471	0	15	4	NEAR POND
5	1005	2041	9/26/8	68M15	471	0	15	4	W OF POWERLINE
5	1006	2042	9/26/8	116S 8A	471	0	20	3	
*****									

Figure 15. Sample Listing of Southern Pine Beetle Spots Needing Ground Check Action for a Timber Company.

REPORT DATE 07-10-78					TEXAS FOREST SERVICE				
LISTING FOR XYZ TIMBER CORP. SUB-UNIT 2									
SPB SPOTS TO BE CONTROLLED									
TFS AREA	TFS SPOT NO.	OWNER SPOT NO.	GROUND CHECK DATE	TFS GRID	COUNTY CODE	ABST. NO.	EST. NO. ACTIVE TREES	PRIORITY	REMARKS
*****									
4	3080	1	5/18/8	279V 4	373	523	25	3	
4	3122	23	6/15/8	278C 2	373	604	100	1	ROBERTS SURVEY
4	3126	24	6/10/8	278E14	373	210	40	1	TO BE SALVAGED
4	3130	30	6/20/8	277E15H	373	109	20	3	
4	3132	33	6/21/8	276C 3	373	999	10	4	WET SITE
*****									

Figure 16. Sample Listing of Southern Pine Beetle Spots Needing Control Action for a Sub-Unit of a Timber Company.

listings. However, all records are retained in computer files for access when needed. Occasionally an "inactive" or "controlled" spot will become re-infested. This occurrence is termed a "breakout." When a breakout is reported, the information will re-appear on the list of spots needing control until the spot is reported a second time as inactive or controlled.

#### Other Listings

Company personnel are responsible for ground checking and controlling spots located on their lands. Infor-

mation concerning these spots is reported directly to the Pest Control Section. To keep TFS field personnel informed of inactive and controlled spots on company lands, a report is produced for each TFS flight sector that lists spots with action completed since the last computer run. This report allows TFS field personnel to update their records and flight maps concerning the status of previously-detected spots. An example of the action complete report is shown in figure 17.

Upon request, the Pest Control Section also can provide a report show-

LISTING OF SPB SPOTS REPORTED WITH ACTION COMPLETE (INACTIVE OR  
CONTROLLED) SINCE THE LAST RUN OF THE OPERATIONAL SUMMARY REPORT

SPOT NUMBER	TFS GRID	SPOT STATUS	DATE	NUMBER OF TREES	TYPE CONTROL
3000		INACTIVE	5/22/8	1	
3001		CONTROLLED	7/11/8	15	1
3002		CONTROLLED	7/11/8	20	1
3003		INACTIVE	5/22/8	1	
3006		INACTIVE	6/29/8	1	
3007		CONTROLLED	6/28/8	30	3
3008		CONTROLLED	6/28/8	10	3
3009		INACTIVE	6/29/8	1	
3010		CONTROLLED	7/11/8	50	1
3011		CONTROLLED	6/30/8	100	1

Figure 17. Sample Listing of Southern Pine Beetle Spots in a Texas Forest Service Administrative Area and Flight Sector that have been Reported Controlled or Inactive Since the Last Operational Computer Run.

ing all information reported on SPB spots for a particular owner or a particular area. Figure 18 shows an example of this printout.

### Administering the System

#### Editing Data

At any one time as many as 50-75 individuals may report SPB data into the OIS. Most individuals possess little experience and knowledge about data processing. Because so many individuals supply data, erroneous information is likely to be incorporated into the system. Errors also result from keypunching or data entry even though the field reports are correct. Various methods are used to keep these errors to a minimum.

As reports are received, the information is carefully checked. Detection reports are checked against maps to see if county codes and grid locations match, while all other reports are checked to assure that the new information is compatible with data already on record for a particular spot. If discrepancies are noted, the information is corrected. Some obvious errors can be corrected by the Pest Control

Section staff either immediately or following a telephone call to the person who reported the information. In other cases, the entire report may be returned to the reporter for correction.

Once the field reports are edited and corrected, the data are entered into the computer. As a preliminary check, the data are sorted and listed on the printer in such a way that misaligned entries and other errors can be easily detected and corrected. Also, the computer programs include edit routines which screen data and detect reports which do not meet certain minimum requirements. These reports appear on the listing of spots with incomplete or insufficient information making it easy to isolate and correct the errors.

#### Operating Procedures

The OIS is a voluntary system for processing large volumes of SPB data. Since at least one-half of all spots reported are located on company lands, the voluntary information supplied by the companies is vital. The cooperation of timber industries has contributed much to the success of the system.

TEXAS FOREST SERVICE DATE OF RUN - 02/04/75														
COMPLETE LISTING OF ALL INFORMATION REPORTED ON INDIVIDUAL SOUTHERN PINE BEETLE SPOTS														
AREA	TFS SPOT NO.	TFS SECT.	DATE	LAST RECORDED TYPE ACTION	TFS GRID	COUNTY	ABST.	OWNER CODE	OWNER SUB-UNIT	OWNER SPOT NO.	ESTIMATED NO. TREES	PRIORITY	TYPE CONTROL	TOTAL NO. CONTROLS BEYOND 1ST.
*****														
OWNER NAME		E.Z.' STREET			REMARKS W OF FIELD									
3	1017	2	FLIGHT 5/ 9/4	5	723E15B	225	9999	99	0	0	10	1		
			GND CK 5/30/4								4	4		
			CONTROL 7/25/4								20		1	
OWNER NAME		TED BILLINGS			REMARKS ON CREEK									
3	1020	2	FLIGHT 5/ 9/4	5	5240 8B	73	9999	99	0	0	10	1		
			GND CK 5/30/4								5	3		
			CONTROL 7/16/4								200		1	
OWNER NAME		J. FRANKLIN			REMARKS									
6	2031	2	FLIGHT 5/ 7/4	6	367Y 6B	339	37	99	0	0	10	1		
			GND CK 5/27/4								115	1		
			CONTROL 7/19/4								200		1	
			GND CK 7/30/4								200	2		
			CONTROL 8/ 6/4								10		1	1
OWNER NAME		N. KING			REMARKS NO PLACE TO GO									
6	2011	2	FLIGHT 4/19/4	6	421B 8F	339	73	99	0	0	15	1		
			GND CK 5/15/4								30	4		
			CONTROL 7/19/4								138		1	
*****														

Figure 18. Sample Output Showing a File Dump of All Information Reported on Individual Southern Pine Beetle Spots.



When the OIS was initiated, an instruction booklet was distributed to field personnel. This booklet describes the system and includes examples of how to report information. It also lists the names and addresses of TFS and company administrators and field personnel, and defines TFS area and flight sector boundaries. Whenever personnel, boundaries or reporting procedures change, updated information is sent to all field offices to keep the instruction booklets current.

The Forest Pest Control Section conducts training sessions for company and TFS personnel to familiarize them with correct reporting procedures or new aspects of the system. If a particular organization or individual has reporting problems, special training sessions are arranged to correct the situation.

Obviously, all reporting problems cannot be alleviated by conducting training sessions. During the third year of operation, reports that contained erroneous or incomplete information were so noted and returned to the reporter with a request that the error be corrected and the report resubmitted. This method allowed the reporter to see and correct his error without a personal contact and, in most cases, prevented the same error from occurring in subsequent reports. Although this method of "training" required some extra time initially, it served to improve the overall quality of field reports.

When reporting troubles persist or reporters are slow in supplying ground check and control information, it is usually a sign that the field staff or supervisor is not utilizing or benefiting from the system. Since the OIS is voluntary, their principal motivation for continued use of the system is to make it work for them. Each individual and organization can benefit from the system in direct relation to the quality and timeliness of the data supplied.

The OIS provides rapid feedback of information to field offices. During the first year of operation, computer reports were mailed weekly during the active beetle season. The reports were changed to bi-weekly the second year--an interval that has proven to be more satisfactory. Also, the cost of computer time for the weekly printouts could become exorbitant if the data bank was large.

### **Additional Considerations**

The flexibility of the system has proved to be invaluable. Voluntary and solicited responses from TFS and cooperating timber industry personnel resulted in some beneficial improvements in the system. The timber volume data and the action complete listing are examples of change. Although the OIS was developed to monitor SPB in Texas, minor modifications of the computer programs would make it adaptable to other pests or for SPB in other states. For instance, in Louisiana where land surveys are by section, townships, and range, SPB spot locations are currently being used in the OIS system without requiring changes in the computer programs.

The amount of data processed depends on the level of SPB activity. For instance, during a severe outbreak such as 1976, over 27,800 records were entered to provide data for nearly 11,000 spots. Over the five-year period (1973-1977) an average of 2.58 records was entered in the system for each SPB spot reported. During these five years, SPB data from the field reports were keypunched on computer cards and then read into the computer via a card reader. The use of a formatted drum card for the keypunch machine to set alpha and numeric modes, skips and stops proved useful. If a computer terminal is available, the card step could be eliminated by entering the data directly to disc storage. Except

during years when SPB activity is extremely high, data entry and processing functions can be adequately handled by one person. Although the ability to sort or edit SPB data for in-house use is useful for administering the system, a thorough knowledge of computer programming is not necessary.

The cost of computer time varies with the type of machine and installation; therefore the costs listed here reflect only the experiences of the TFS. During 1975, direct computing costs were \$3,644, 1976 were \$4,110 and 1977 \$2,524. The variation is attributed mainly to volume of data processed.

Since the computer output (spot listings and summaries) are distributed by mail, postal charges are a major cost. Mail rates, number of persons receiving output, volume of data and format of printout all influence mail volume and costs. During an "average" SPB year, like 1975, first class postage charges for mailing out OIS bi-weekly summaries amounted to about \$600.

### **Summary**

Since it was established seven years ago, the OIS has provided timely

and useful information to field personnel and administrators in forest industry and the Texas Forest Service. During this time beetle populations reached the highest levels ever recorded in East Texas. Its function as a voluntary system has proven successful because it provides beneficial and current information to its users without requiring unrealistic inputs--field reporters can see direct and immediate returns from their reporting efforts. The computer-based system has made it possible for the first time to monitor an entire outbreak on a continuing basis. Because of this, it has enabled pest managers to react in a timely fashion when problems develop or situations change and to better utilize limited resources of man-power and equipment.

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